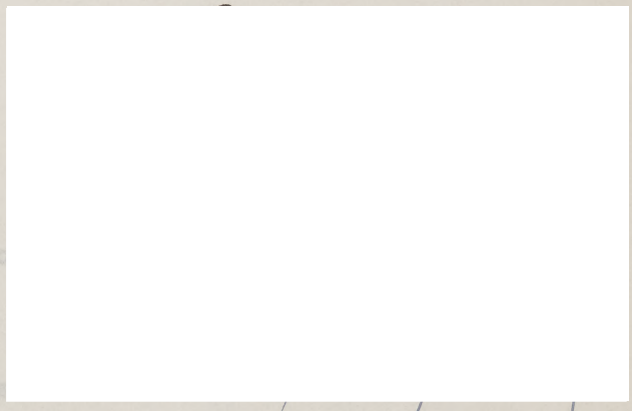
THE PETTUS FIELD, BEE COUNTY, TEXAS

Approved:



Approved:

Dean of the Graduate School.

June 1, 1932.

THE PETTUS FIELD, BEE COUNTY, TEXAS

THESIS

Presented to the Faculty of the Graduate School of
The University of Texas in Partial Fulfill-
ment of the Requirements

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By

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THE PETTUS FIELD, BEE COUNTY, TEXAS

LOCATION

The Pettus field is located on the Coastal Plain in the northeastern part of Bee County, Texas, about 75 miles southeast of San Antonio and 15 miles north of Beeville, the county seat of Bee County. The Texas state highway number 16 and the Southern Pacific Railroad pass through Pettus, and the field is easily accessible in all weather from either city.

Geologically the Pettus field is in the region of Upper Tertiary rocks on the Raccoon Bend-Laredo trend, which has seen so much leasing and drilling activity during the past few years.

TOPOGRAPHY, DRAINAGE, and VEGETATION

The outstanding topographical features of this area are the caliche-topped hills. These hills are 300 to 500 feet in elevation. The soil is generally poor; some cotton is raised but the land is generally used for grazing purposes.

There are no rivers in this area, but there are several intermittent streams, the largest being Medio and Blanco creeks.

The vegetation consists chiefly of various species of chaparral. The most common are mesquite, huisache, and cat-claw. There are some scrub oaks and great numbers of cactus. Where the growth has not been cleared away it is very thick.

HISTORY OF DEVELOPMENT

Leasing became active in this area during 1928. The leasing was done on a trend play between Raccoon Bend and Laredo, two areas that were producing oil and gas from the Jackson. The first well was drilled by Dr. Hewitt and associates on the Ray ranch in the latter part of 1928. The well was located near a small sink and a quartzitic knob, such as are common to southwestern Texas. Gas was discovered at 2900 feet. The Moody-Seagraves and Morgan interests purchased the properties and interests of Hewitt et al and drilled an offset to the well where the same gas sand was encountered at 2900 feet. This well was the first commercial gas well of the area. Several wells were drilled by the Moody-Seagraves and Morgan interests, known as the Mission Drilling Company, and a small oil well, Ray No. 3, was brought in on the Ray ranch in Goliad County in the fall of 1929.

In December, 1929, the Houston Oil Company, having obtained the gas rights on the Humble Oil and Refining Company-McKinney lease, tested the first well to produce oil in commercial quantities in this area. This well was finally brought in on January 31, 1930, for an initial production of 500 barrels. This discovery initiated an intensive drilling campaign. The discovery well of the Cosden pool was brought in on May 23, 1930, on the R. A. McKinney tract west of Pettus. On July 4, 1930, the discovery well of the Pettus townsite was brought in by the Houston Oil Company on Block 36. Subsequently, drilling went on at a rapid pace, and the field has been fairly well defined and only isolated highs producing small quantities of oil are now being discovered in outlying areas.

Altogether, 85 tests have been drilled in the area studied. The peak of production was reached in December, 1930, with a daily average of 8406 barrels. There are some wet gas wells in this district and some of them have been produced for gasoline. The gas is used mostly for drilling purposes. However, the Sun Oil Company is selling their gas to a pipeline serving San Antonio.

There are four loading racks and two pipelines, the Humble pipeline and the Gulf Coast pipeline, serving this area.

STRATIGRAPHY

Pleistocene and Recent

Caliche.--In this area are found thin deposits of caliche. It is an impure white calcium carbonate, sometimes being very sandy. At one time considerable discussion was going on about the origin of caliche--whether it was sedimentary or due to the upward movement of lime-dissolving waters. The latter supposition is generally accepted by the geologists who have worked over this area. Sometimes the caliche is very sandy or even silicified. This is probably due to the movement and subsequent deposition by silica-dissolving waters. The caliche is placed in the Reynosa by some workers but it seems that no definite age can be assigned to the caliche as it is being deposited even to the present time, the only necessary condition being some calcareous formation, such as the Lagarto in this area, from which the caliche may be derived.

The surface soil and caliche have a thickness of 20 to 70 feet. In some wells, for instance Houston Oil Company No. 1 Neuman, the quartzite was drilled through.

Tertiary

Pliocene

Lagarto.--The oldest beds that appear at the surface in the Pettus

field belong to the Lagarto formation of Pliocene age. This formation outcrops chiefly in road cuts and on the banks of Medio and Blanco creeks. The Lagarto consists chiefly of pink, green, yellow, and lavendar clays and of gray and yellow cross-bedded sandstones and yellow sands. The bedding is very poor. Because of the lenticular nature of the beds and the discontinuous outcrops, it is extremely difficult to work out a surface section or to measure the dip of the formation. The gray sandstone in Medio Creek near the town of Pettus has been assumed by some to be Reynosa, but because of its position, being underlain and overlain by typical Lagarto clays, and its isolated nature the writer has concluded that it is a sandstone in the Lagarto.

The Lagarto has a thickness of from 400 to 600 feet in the field. Some reworked Cretaceous foraminifera, Cristellaria, etc., and fragments of fresh water pelecypods have been found in samples.

Miocene ?

Oakville.--The Oakville has been referred to the Miocene by most workers. It contains no marine fossils, that is, none have been found at the outcrop or in subsurface samples from the Pettus field. It must be remembered that the contact of the Lagarto and Oakville, as on the surface, cannot be placed definitely. The Oakville consists of about 400 feet of green clay, lime, and gray sand. Reworked Cretaceous foraminifera have been found in well samples from the Oakville.

Oligocene? - Eocene?

Gueydan-Frio.--Some of the late workers have placed the Gueydan in the Lower Miocene, but it is herein placed questionably in the Oligocene. There has also been some debate whether the Frio is Upper Eocene or Lower Oligocene.

In subsurface determinations, the Gueydan of Bailey[1] and the Frio are often grouped together because of their similarity and the difficulty of marking the contact. The Gueydan-Frio consists of green limy shale, white and yellow lime, and gray sandstone. Microscopically the Gueydan-Frio is seen to contain small angular quartz grains, pyrite, glauconite, and volcanic ash. Sometimes lime in the shale has been mistaken for volcanic ash. It is believed that some workers have erred in calling a slightly fossiliferous horizon in the Frio, Jackson. Fragments of pelecypods have been found in a sample from the Barnsdall Oil Company No. 1 Roberts that is overlain and underlain by typical Frio. A foraminifera, like Textularia mississippiensis, was found in cuttings at 2434-46 in the Southern Crude Oil Purchasing Company No. 1 Dahl. The cuttings are typical Frio.

In the lower part of the Frio, at the outcrop and in well samples, is a fossiliferous horizon in shale that looks very much like Fayette shale as it is known in the Pettus field. This leads to some mistakes in placing the top of the Jackson in the Pettus area.

Eocene

Jackson

The Jackson in the Pettus field has been divided into three members: Fayette, McElroy, and Diboll.

Fayette.--Deussen[2] describes the Fayette as "made up of gray

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1 Bailey, T. L.: "The Gueydan, a New Middle Tertiary Formation from the Southwestern Coastal Plain of Texas," University of Texas Bulletin 2645, 1926.

2 Deussen, A.: "Geology of the Coastal Plain of Texas West of the Brazos River," U. S. Geological Survey, Professional Paper 126, p. 85, 1924.

sandstone and sand, brown and chocolate-colored clay, and lignitic clay and lignite." In the Pettus field, the sandstone is not present, due either to non-deposition or erosion. The Fayette in the Pettus field consists of 300 to 700 feet of greenish-gray clay and shale, commonly called the "black shale", lime, rounded quartz grains, and crystals of pyrite. Due to the fact that the Fayette is sparsely fossiliferous, some workers have placed the top of the Fayette above the point where the first forms are found. At the best, the top of the Fayette is very indefinite. Some of the foraminifera found in the Fayette are Nonionina scapha, Globigerina sp., and Haplophragmoides sp.

McElroy.--The McElroy member consists of from 200 to 800 feet of greenish-gray clay, limy clay, lime nodules, rounded quartz grains, pyrite crystals, calcite, and flint particles. Lithologically the McElroy beds are similar to the Fayette but the McElroy is more fossiliferous and contains a different faunal assemblage. The McElroy is characterized by Textularia hochleyensis. Other forms found in the McElroy are Textularia mississippiensis, Discorbis jacksonensis, Cristellaria limbosa var. hochleyensis, and small pelecypods and gastropods such as Corbula and Turritella.

Diboll.--The Diboll is the lowest member of the Jackson in the Pettus field. This member consists of from 150 to 200 feet of greenish-gray shale and clay, sometimes calcareous, greenish-gray sand, rounded quartz grains, pyrite crystals, and glauconite. The Diboll is the most fossiliferous member of the Jackson. Beginning 20 feet above the producing sand the Diboll is seen to consist chiefly of large-sized forms, mainly pelecypods, in a matrix of clay or shale. The characteristic form of the Diboll is Textularia dibollensis. It also contains Textularia mississippiensis, Nonionina hantkeni, Nodosaria laevigata var. ovata,

Quinqueloculina sp.?, ostracods, sponge spicules, and shell fragments.

The age of the producing sand has not been definitely settled. Miss Alva Ellisor[3] of the Humble Oil and Refining Company and others have placed it in the Cockfield. Others have placed it in the lower part of the Diboll. The writer can find no reason to place the sand and some of the shale above it into the Cockfield so it is tentatively placed in the Diboll member of the Jackson.

Claiborne Series

In the deeper wells of the Pettus field, the Jackson has been drilled through and Middle Claiborne or Cook Mountain has been penetrated.

Yegua.--Paleontologists in their determinations have separated the Cockfield from the Yegua. From Miss Ellisor's[4] paper in the Bulletin of the American Association of Petroleum Geologists for October, 1929, it seems that Cockfield and Yegua are synonymous and, therefore, one should be dropped or reduced to a member rank. Other geologists have concluded the Cockfield can be correlated with the "Bulimina jacksonensis" zone which Mrs. Applin placed below the Textularia dibollensis zone. Moree[5] states: "My conclusion is that the "Bulimina" zone is a horizon in the Textularia dibollensis zone in Texas and that the term "Bulimina jacksonensis zone" should be abandoned. Textularia dibollensis seems to have a much wider range geographically and should be used as a zonal

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3 Ellisor, Alva: Lecture before the San Antonio Geological Society, summer, 1930.

4 Ellisor, Alva: "Correlation of the Claiborne of East Texas with the Claiborne of Louisiana," Bulletin of the American Petroleum Geologists, Vol. 13, No. 10, p. 1339, 1929.

5 Moree, R. W.: "Note on the 'Bulimina jacksonensis zone'," Bulletin of the American Association of Petroleum Geologists, Vol. 14, No. 2, p. 227, 1930.

name at the expense of "Bulimina jacksonensis", which occurs in the lower part of the Textularia dibollensis zone in several places."

The Cockfield and Yegua consist of glauconitic shales and clays and sands. They range in thickness from 150 feet in the Humble Oil and Refining Company No. 8 McKinney to 1520 feet in Union Producing Corporation (Mission Drilling Company) No. 3 Ray.

Cook Mountain.--Only the Upper Saline Bayou[6] of the Cook Mountain has been penetrated in the Pettus area. It consists of glauconitic shales and clays and some sands. The greatest thickness drilled in this vicinity was in Morgan No. 1 Boyce in Karnes County. Union Producing Corporation (Mission Drilling Company) No. 3 Ray penetrated 438 feet before plugging back to the Pettus sand.

STRUCTURE

Surface Structure

The outcrops of the formations in this area are of very little assistance in determining structure. The Pettus field is located upon some high hills which should be in the normal outcrop of the Reynosa formation. The area has no Reynosa but the caliche is underlain by typical clays of the Lagarto. In this case, as all along the Raccoon Bend-Laredo trend, much of the leasing was done on Lagarto "highs", being high hills of Lagarto in the normal Reynosa outcrop and thought to be indicative of structure. The Reynosa-Lagarto contact should pass through Pettus but it swings far to the south in Goliad County, before crossing into Bee County, northwest of Berclair.

A fault has been reported to be exposed on Medio Creek at the southwest corner of the Pettus townsite. This place has been visited

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[6] Ellisor, Alva: Ibid., p. 1339.

by the writer and another geologist, but no evidence of faulting could be found.

An interesting feature of the Pettus field and surrounding country is the rather numerous knobs of quartzite. These knobs are found in the field and just south of it where they exhibit a circular pattern. Row[7] says:

> "----In the northern portion of Bee County there is a great abundance of silicified material with no definite alignment or arrangement, suggesting that waters laden with silica may have spread laterally through coarse sands and sandstones for considerable distances from the vents before depositing their loads. --- In one locality there are dike-like stringers of siliceous rocks extending out in several directions from a somewhat circular mass. Someone has explained this arrangement by the theory that a geyser or big spring once occupied the position of the central siliceous body, and that the various stringers are old stream channels leading away from the vent.
>
> "The siliceous rock just east of Pettus may be associated with the structure that is now yielding both gas and oil."

Some geologists have claimed that the knobs just south of Pettus can be lined up with the subsurface fault on the western edge of the townsite but upon careful mapping of these knobs it is seen that they exhibit the circular mass theory as explained by Row in the above note. These knobs may be related to the faulting in the Pettus field but their relationship has not been shown.

The origin of these knobs seems to have been in the Frio and Gueydan which contain considerable volcanic material. Circulating waters carried siliceous material in solution upward through vents or fractures depositing it on all sides of the opening.

Subsurface Structure

At the north end of the Pettus field is shown the continuation

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7 Row, C. A.: Chalcedony and Siliceous Sandstone Knobs in Southwest Texas and Their Relation to Oil and Gas Production, unpublished manuscript, 1930.

of the Hord's creek fault, striking N79E, from its exposure on Hord's Creek, Goliad County, Texas. It is not known whether the Hord's creek fault extends over into Bee County.

In the discussion of a paper[8] on the Pettus area, L. P. Teas says: "Perhaps the greatest indication of structure in the Pettus field is the fact that the Union Producing Company No. 30 Ray....." is..... "323 feet higher than the Union Producing Company No. 4 Ray, which is slightly more than one-half mile southeast." From a study of the structure map it will be seen that No. 30 Ray is less than 100 feet higher on the sand and that No. 4 Ray is more than three-quarters of a mile southeast of No. 30 Ray. This difference in elevation of the sand can be accounted for by normal dip, which is 125 feet to the mile on the Jackson in this area.

No. 1, No. 2, and No. 24 Ray are producing gas from a thin sand in the base of the Frio.

It is extremely difficult to account for the sudden drop in elevations on the Pettus sand in No. 25 and No. 6 Ray. One fault was drawn between No. 25 and No. 6, one between No. 25 and No. 4, and one between No. 6 and the field. These faults are all parallel, striking N56E. Both No. 25 and No. 6 Ray had a salt water sand in the Yegua but no sand was penetrated in the Diboll member of the Jackson. By interpolating between No. 4 Ray and No. 5 Ray in the field, on the top of the Diboll member, No. 25 Ray was found to be about 215 feet lower than No. 4 Ray, and nearly 100 feet lower than No. 6 Ray, which is 40 feet lower than No. 5 Ray.

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8 Brace, O.L.: "Factors Governing Accumulation of Oil and Gas in Mirando and Pettus Districts, Gulf Coastal Texas, and Application to Other Areas," Bulletin of the American Association of Petroleum Geologists, Vol. 15, No. 7, p. 789, 1931.

The discovery area and the Pettus townsite seem to be one pool. The contours on the Pettus sand show a monocline striking N45E and dipping about 125 feet to the mile. In the field proper the dip increases to nearly 200 feet to the mile. In this area, the monocline is seen to be warped into small noses with axes at right angles to the strike. At the west side of the townsite the pool is cut off abruptly by a fault striking N36W. Nothing but a fault could explain the difference in elevation of the sand (142 feet) in Glasscock Brothers No. 1 Hodges, Block 41, Pettus townsite, and in the Rio Bravo Oil Company No. 7 Right-of-Way.

In the Cosden pool the Pettus sand is encountered at depths from -3247 to -3309 feet. Between this area and the Southern Crude Oil Purchasing Company No. 1 Dahl there is a shallow syncline with a slow dip from the No. 1 Dahl southeastward. From the Sun Oil Company No. 1 Barnett to Weinert and C. R. M. No. 1 Ray there is a drop of 340 feet. A fault is drawn between these two wells striking N48E.

Oil has been discovered in two spots south and southeast of the fault just mentioned. Some geologists are inclined to believe that these productive wells are controlled by minor faults but it appears that these are only local "highs" upon which oil has accumulated.

There are three types of structure in the Pettus field upon which oil has accumulated and these are: noses on a monocline, faults, and local "highs". The gas occurs up dip and is usually associated with gasoline. The contact between the gas and the oil is fairly definite. The sand from the Pettus townsite wells seems to be coarser grained than the sands from the Cosden area wells.

The Pettus sand was probably a near shore deposit. The sand rarely contains a fossil. After the erosion of the Yegua the sand was laid down upon the eroded surface of the Yegua. Locally the sand may be absent as, for instance, in Humble Oil and Refining Company No. 8 McKinney and Union Production Corporation No. 25 and No. 6 Ray, but the sand has been traced into Goliad and Dewitt counties on the east and into Live Oak County on the west.

The sand in the Pettus field proper and in the Cosden area is the same, judging from lithologic and paleontologic similarities. The Jackson is thinner in the Cosden area than in the field proper. If the paleontologic determinations are correct it may be assumed that the Cosden area was uplifted before the Fayette was completely deposited, and while the Cosden area was above water (Fayette sea), the remainder of the Fayette was deposited in the rest of the field. Subsequently, the Fayette was removed in part.

It is not possible at the present time to determine the time of the faulting in the Pettus field. There are no exposures or evidence of faulting on the surface in the Pettus field; therefore, it may be assumed that the faulting is not post-Pliocene. The faulting in the Pettus field was probably contemporaneous but was no doubt preceded by the warping of the sediments. Following this the oil accumulated on the several traps: noses, faults, and local "highs".

PRODUCING HORIZONS

There are lenses of sand in the Lower Frio which are productive of gas in the Pettus field. Gas was discovered at about 2900 feet in No. 1 and No. 2 Ray. At 2851 feet No. 24 Ray made a gas well. No. 4 Ray had gas shows from 2558 to 2763 feet.

The main producing horizon in the Pettus field is in the lower part of the Diboll member of the Jackson. It is usually capped by a hard, impervious sandstone from one to two feet in thickness. The "cap rock" is not productive but in some cases has an oil odor. Where the producing horizon is not capped by the hard sandstone, a hard shale is found above the sand.

The producing horizon is a greenish-gray, fine to medium grained sand with some shale. Microscopically the sand is seen to contain rounded quartz grains, glauconite, biotite, and foraminifera in rare cases. The biotite flakes seem to be a distinguishing criterion of the sand all over the field. The sand is from 10 to 45 feet in thickness, but it will be noted that the greater thicknesses contain breaks of shale, which are several feet thick in some cases. Ordinarily, about 14 feet of sand was taken before setting screen.

The producing horizon possesses gas, oil, and water (salt) in various places in the field. The sand produces a wet gas. The oil, while not produced in large quantities, is high gravity--46.6 degrees A.P.I.

O. L. Brace[9] has placed the producing horizon of the Cosden pool in the Diboll member of the Jackson and he placed the sand of the discovery area in the Cockfield. The sand from both places is similar lithologically and is herein placed in the Diboll member.

PRODUCTION METHODS

Drilling in the Pettus field is done exclusively by the rotary method. The great thicknesses of soft clays and shales make the use of standard tools impracticable and unprofitable. Ordinarily, wells are

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[9] Ibid., p. 781.

completed in about 30 days. In some wells where the quartzite is encountered a longer time is required.

Water is obtained from a sand at a depth of about 200 feet in the Lagarto. At first, gas for drilling was obtained from a nearby pipe line but it is supplied mostly by wells in the field now.

Surface casing is usually set at from 150 to 500 feet to case off the water sands. Usually, 10 or 12 inch casing is used. Fish tail bits and four inch drill stem are ordinarily used in drilling the wells.

When the sand is reached, a five foot core is taken. Then a test tool is run to give the operator an idea about the productivity of his well. If the test warrants it, six and five-eighths casing is set upon the "cap rock" and the cement is allowed to set for ten days.

After the plug is drilled, screen is set, usually .018, with two or two and one-half inch tubing. Then the "Christmas tree" is rigged up with four flow lines, two lines from the tubing and two lines from the casing. The well is then washed out and it is swabbed until it starts to flow. The well is produced through the tubing which has a choke hooked on at the flow line. The well is usually choked to three-eighths inch.

The wells produce about 300 barrels when they are brought in. The largest producer was the Houston Oil Company No. 1 Beasley, Block 36, Pettus townsite. This well came in for an initial production of 1000 barrels per day.

It has been estimated that the Pettus townsite and the discovery area will produce about 25,000 barrels to the acre, while the Cosden pool will produce about 9000 barrels to the acre.

During the early summer of 1931 some of the wells on the Pettus townsite went down in production. These wells were put on the pump but trouble was had with rods and tubing because of crooked holes. The

gas wells have too small a volume to use gas lift. Cosden has two wells flowing through tubing with packing, and some wells can be helped in this manner. Lack of fluid is a big handicap. Apparently there is no water behind the oil, although edge wells had water on drill stem test. The introduction of water into the lower part of the sand may help to displace the oil and thereby cause the wells to flow.

CHARACTER OF OIL, GAS, and WATER

"Eighty-five percent gasoline by combined skimming and cracking has been obtained in recent tests from crude oil produced in the Pettus field, Bee County, Texas."[10]

This crude has a low knock rating.

"Pettus crude is very low in sulphur and has napthenic characteristics. A distillation analysis of a sample of Pettus crude is shown in the following table. It is significant to note that 82 percent of the crude oil boils below 572 degrees F. and is made up of gasoline and kerosene:

A.P.I. grav.	46.6
Initial B. P. degrees F.	135
End B. P. degrees F.	740
Sulphur, percent	.012

Per cent distilled over	A. S. T. M. (100 cc. distillation) degrees F.
10	223
20	266
30	312
40	362
50	410
60	463
70	508
80	564
90	710
95	730

The gravity of the straight run gasoline was 55.9 degrees."[11]

Considerable gas is produced from wells high on the structure. The gas is of good fuel quality but contains gasoline. This gas was run

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10 Egloff, G., Nelson, E. F., Truesdell, P.: "High Gasoline Yield from Pettus Crude," The Oil and Gas Journal, April 16, p. 30, 1931.

11 Ibid., p. 30.

through a separator by Glasscock Brothers and the gasoline was sold to the general public.

There is no analysis of the water available. The water tastes slightly salty but no hydrogen sulphide can be detected.

CONCLUSION

The Pettus field is on the Raccoon Bend-Laredo trend. The oil is found in a fine to medium grained sand of disputed age, but herein placed in the Diboll member of the Jackson formation. It is a deposit laid down near shore. Stratigraphy and structure in this area are very complicated. The area to the north of the townsite should be drilled in order to determine the structure. The oil is 46.6 degrees A.P.I. of high gasoline content but having a low knock rating. Future drilling along the trend will undoubtedly uncover other such productive areas.

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EXPLANATION OF ILLUSTRATIONS

Figure 1. Topographic map showing the location of the Pettus field and the approximate contact of the Reynosa and Lagarto.

Figure 2. (A) Curve showing the monthly average production from June, 1930, to July, 1931. (B) Curve showing the total production from June, 1930, to July, 1931.

Figure 3. Monthly average rock pressure of Union Producing Corporation No. 16 Ray. Curve showing the monthly average rock pressure of No. 16 Ray from September, 1930, to July, 1931.

Figure 4. North-south cross section of the Jackson in the field. The following wells were used in making this section: 1, Southern Crude Oil Purchasing Company No. 1 Dahl; 2, Cosden and Rowan No. 1 Freeland; 3, Sun Oil Company No. 1 Barnett; 4, Weinert and C. R. M. No. 1 Ray; 5, T. B. Slick No. 1 Ray; 6, Damac No. 1 Ray; and 7, Morgan-Tidal No. 1 Ray.

Figure 5. West-east cross section of the Jackson in the field. The following wells were used in making this section: 1, Buchanan No. 1 Ray; 2, Trinity Drillers No. 1 Roberts; 3, Glasscock Brothers No.1 Hodges; 4, Humble Oil and Refining Company No. 1 McKinney; 5, Union Production Corporation No. 6 Ray; 6, Union Production Corporation No. 10 Ray; and 7, Humble, Lackey and Weldon No. 1, Goliad County.

Figure 6. Structure map of the Pettus field contoured on the Pettus sand. Contour interval, 10 feet. A-A' is the north-south cross section. B-B' is the west-east cross section.

KARNES COUNTY
BEE COUNTY
KARNES
BEE
GOLIAD
COUNTY
LINE
ANTONIO
Creek
RIVER
Medio
Green
Pop. 25
Monteola
Pop. 50
Lotts Ranch
Caesar
Pop. 15
Pettus
Tuleta
Normanna
Pop. 200
Mineral
Pop. 200
Bronson Ranch
Berclair
Pop. 200
Charco
Pop. 150
Hord
Lagarto
Reynosa
Poro
Tero
Cr
Blanco
Arkansas
Cottonwood
Hon
Cabeno
Mu correra
Millers
Richland Creek
Creek
Ry.
SAN
ANTONIO
FOND
GOLIAD
BEE
TO BEEVILLE
25 w tres ht 4'
164 s tr 95 & 97 w approaches ht 42' slope 10° & 20° d 32'
77' st trestle 20' & 55' w approaches, ht 26' f dry
52 s tr 12 ar dif w approaches dry
125 w trestle (dry bed)
164 s trestle, 97 & 99 w approaches ht 42' slope 10° and 20° f
50' s tr ht 20'
120 s tr ht 40' width 12' sl 45° 15' 64 s tr ht 20' 116'
210 w tres
165 w tres
48 w tres
120 w tres
285 w tres
60 w tres
150 s tr 155 w tres
176 s tr w approaches ht 17', sl 30° & 40°
(Beeville)
(Refugio)
(Mckenna)
28°30'
98°00'
97°30'
40'
50'

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W. W. Merrill, 1st. Lieut. 3rd F. A.,
Authority for Topography.
Surveyed 1908 - 1909.

---- = Approximate Contact of Reynosa + Lagarto

Legend
Oak
Mesquite

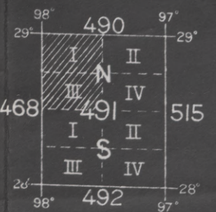
Scale 1/125000

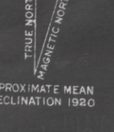
1 0 1 2 3 4 5 6 7 8 9 miles
1000 0 5000 10000 15000 yards
1 0 1 2 3 4 5 6 7 8 9 10 11 kilometers

Contour Interval 20 feet

Datum is mean sea level

NOTE: OFFICERS USING THIS MAP WILL MARK HEREON CORRECTIONS AND ADDITIONS WHICH COME TO THEIR ATTENTION AND MAIL DIRECT TO "THE CHIEF OF ENGINEERS, WASHINGTON, D.C."





APPROXIMATE MEAN DECLINATION 1920

REPRINT ENGINEER REPRODUCTION PLANT, U.S. ARMY, WASHINGTON BARRACKS, D.C.
1924

Figure 2
Production Curves

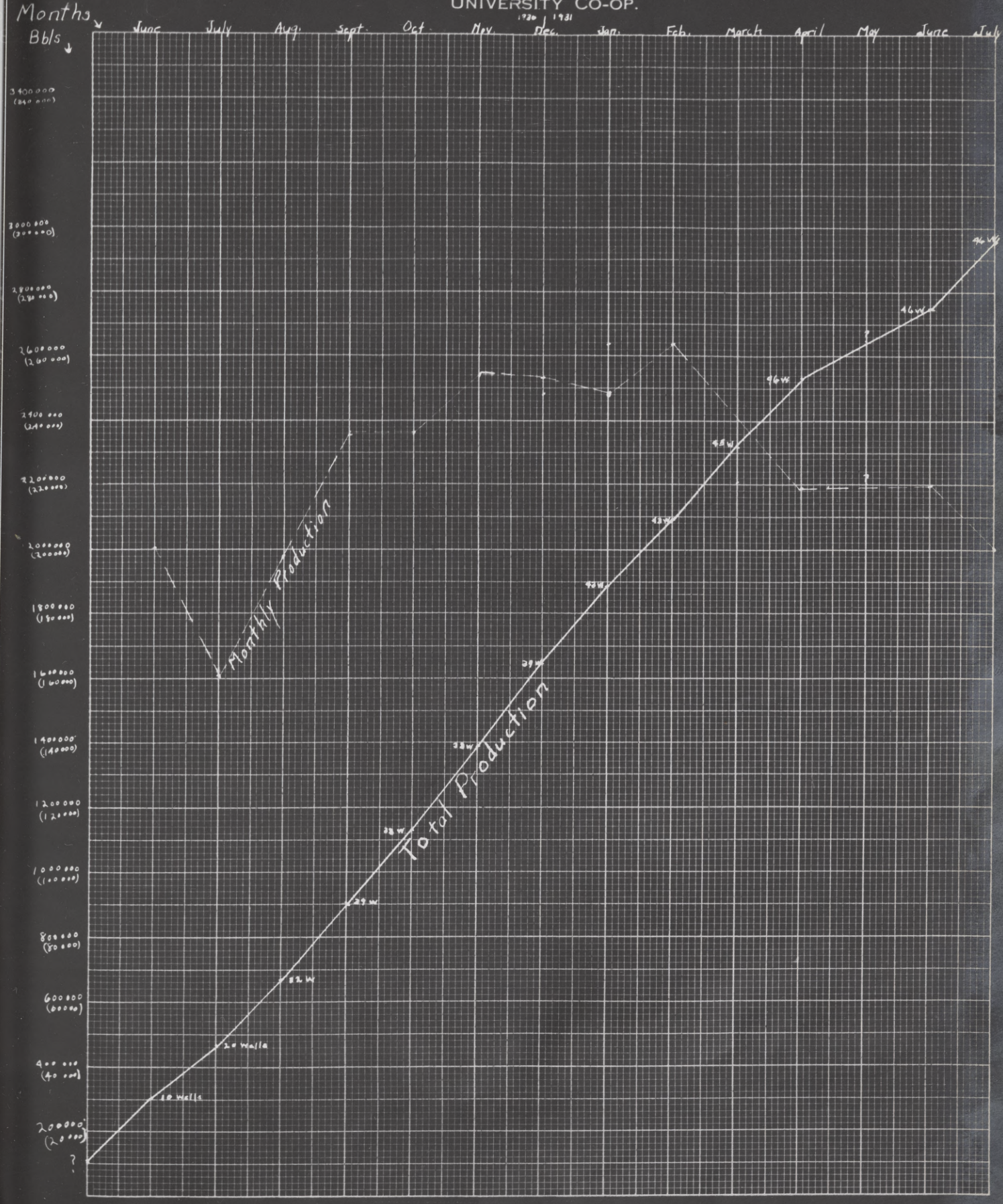


Figure 3

MONTHLY AVERAGE ROCK PRESSURE
UNITED PRODUCING CORPORATION, RAY No. 16.
PETTUS FIELD, BEE COUNTY, TEXAS.

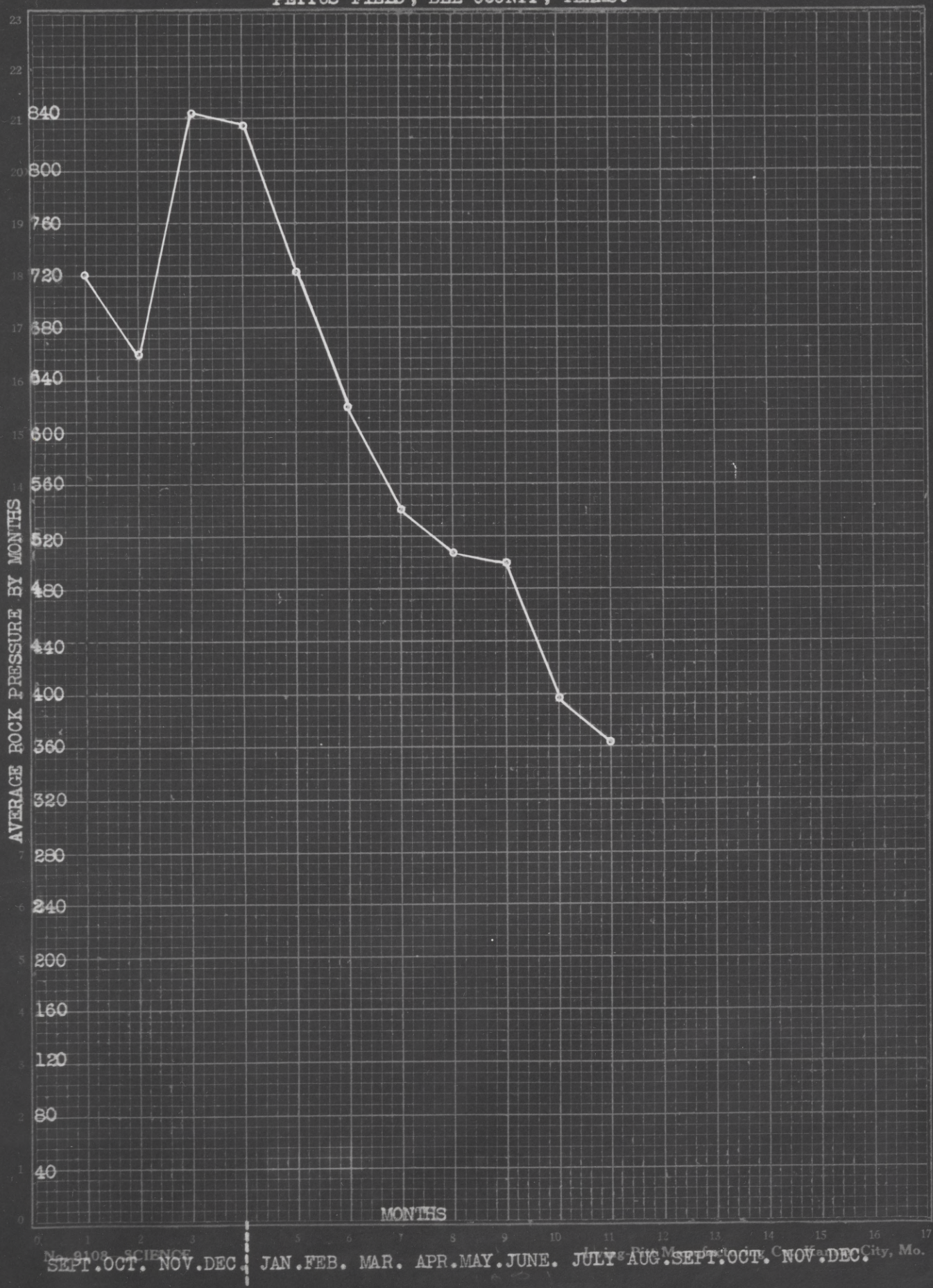


Figure 4

North-South Cross-Section of the Jackson in the field

UNIVERSITY CO-OP.

Scale — Vertical-1"=542' Horizontal-1"=2000'

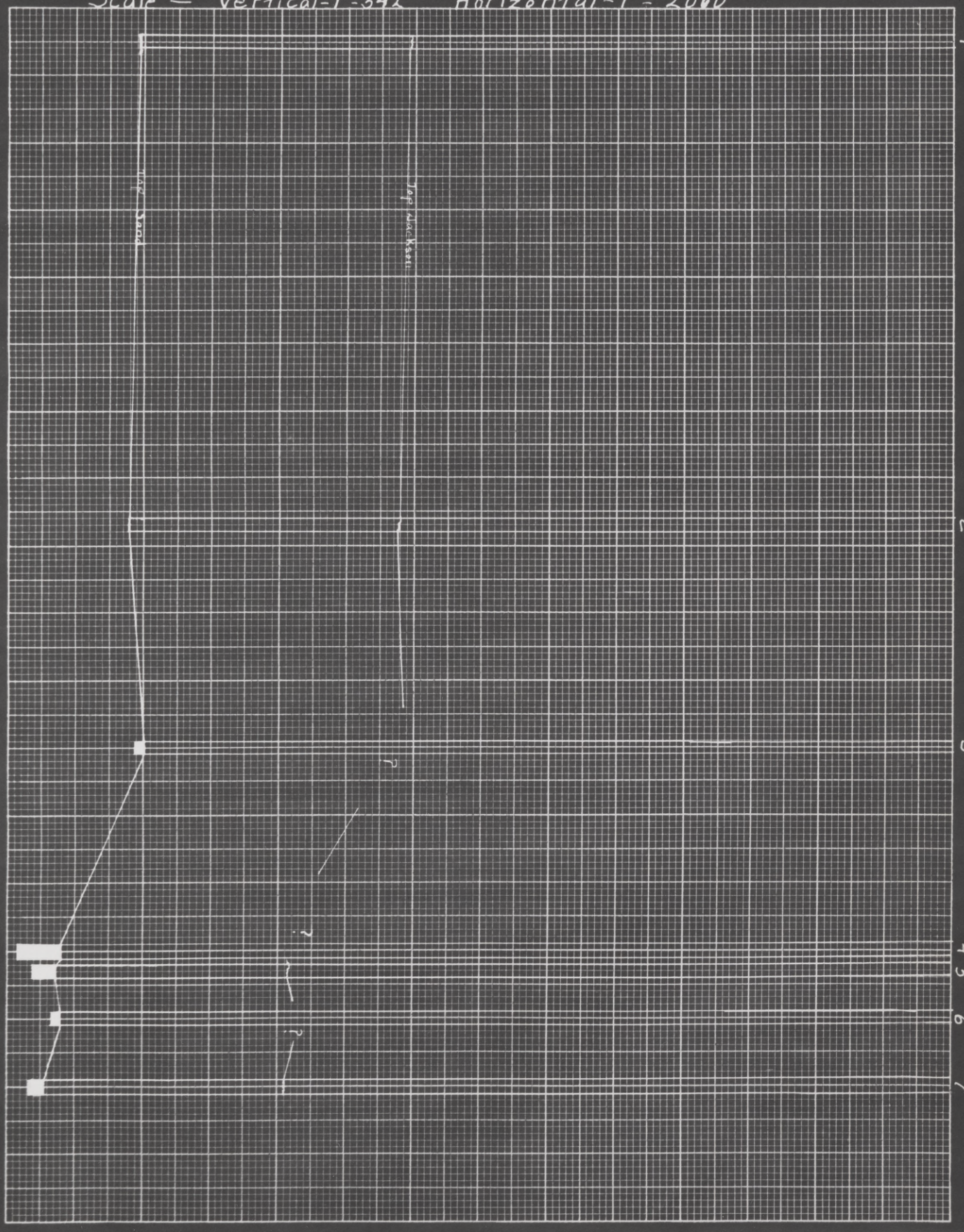
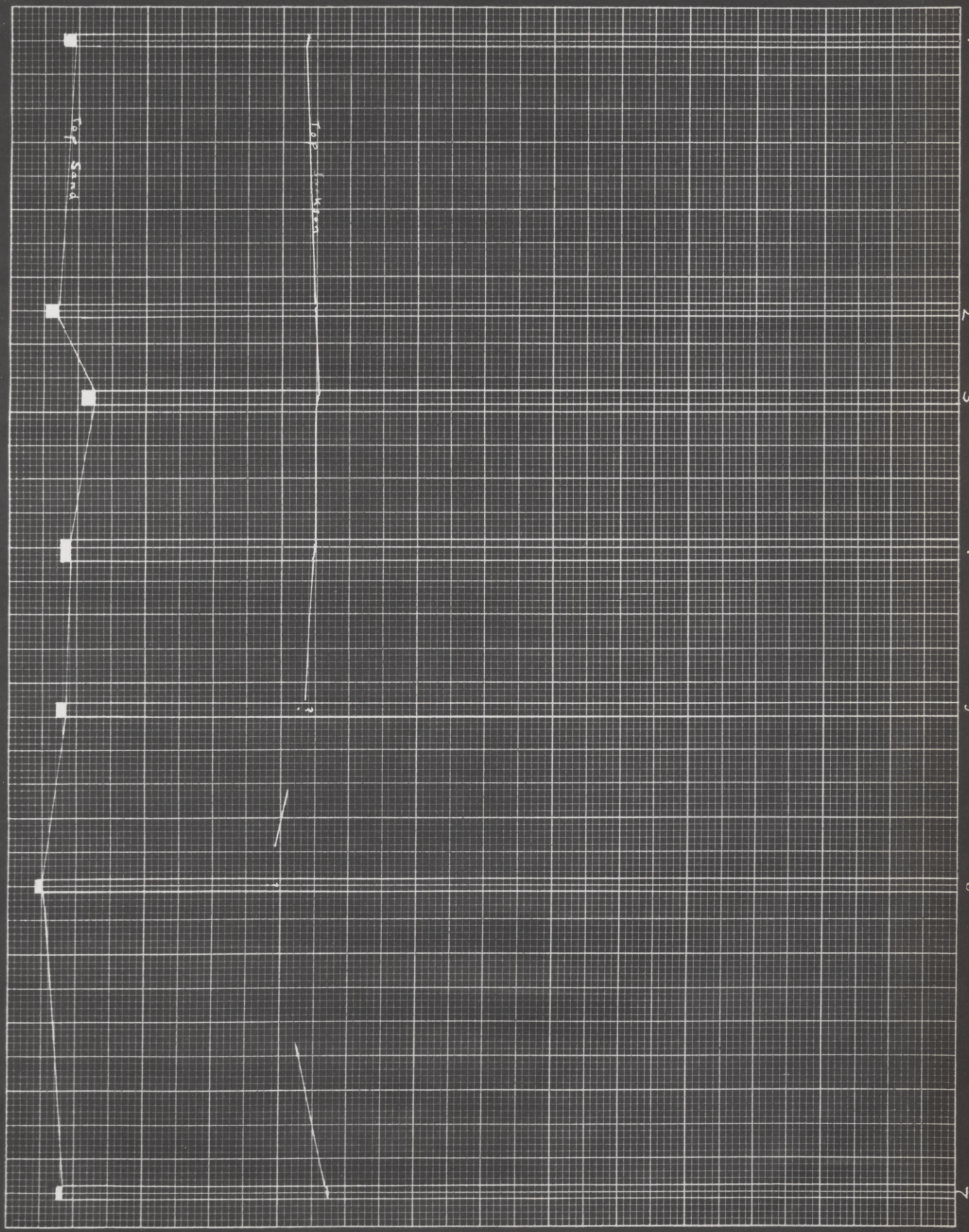


Figure 5

West-East Cross-Section of the Jackson in the field

UNIVERSITY CO-OP.



Rowan & Hope 40 A.
Texas
Southern Crude 184 AA
H. Dahl 224A.
Maggie Moore 310A.
Indep. Oil & Gas & Tidal Oil Co. 200A.
Mrs. Imogene Hall
Geo. A. Ray 643A.
Union Prod. Co.
W.J. PORTER
Geo. A. Ray 624A.
Barnsdall
100 A
ELIZABETH TALLY
Mrs. C.F. Porter
Shell
C.A. Mudd
Humble
Union Prod. Co.
D. M. SHROPSHIRE
Geo. A. Ray
Union Prod. Co.
B. S. & F.
Union Prod. Co.
Humble
J. L. Courtney 471 3/5 A.
Union Prod. Co.
Geo. A. Ray
Gulf
Sun
J. E. Copeland 350A.
Gulf
Geo. Courtney 242 1/4 A.
57 1/2 A.
Union Prod. Co.
Barnsdall Oil Co.
JNO. PACE
Mrs. Mary Carroll 350 A.
Gulf
A. Hardgendorff 200A.
GEO. A. KERR
Union Prod. Co.
PIERCE MILLER
Geo. A. Ray
Geo. A. Ray 547 1/2 A.
B. & B.
Rowan-Tong & Cosden
J.M. Freeland 300A
Texas
Sixto Alvarez 47 3/4 A.
Gulf
37 A.
Houston Oil Co.
200 A.
Houston Oil Co.
Newman 197 1/2 A.
Barnsdall
Leroy Roberts 225 A.
Barnsdall
213 A.
T.B. Slick
Geo. A. Ray
138 1/2 A.
Geo. A. Ray 1975 A.
GEO. NEIL
Geo. A. Ray
Geo. A. Ray
H.A. Smith et al 150 A.
Cosden 200 A.
R.A. Mc Kinney 350 A.
Batex 100 A
Sun
Mrs. H.J. Burnett 300 A.
Texas
E. Grammell.
42 1/2 A.
89 3/4 A.
PETTUS
Houston Oil Co.-Gas
Humble - Oil
Union Prod. Co.
Wm F. Morgan
Union Prod. Co.
Houston Oil Co. 200 A.
Mc Kinney 84 3/4 A.
J. L. Maudlin 16A.
50A.
Creek
Union Prod. Co.
THOS. HANSON
Geo. A. Ray
Union Prod. Co.
WILLIS A. MOORE
Blanco Creek
Geo. A. Ray 1476 A.
Houston Oil Co. - Gas
Humble - Oil
Buchanan
Weinert
Wm F. Morgan & Tidal Oil Co.
Humble
Humble
JNO. W. WILLIAMSON
Geo. A. Ray
Mesta
Morgan & Tidal
Houston Oil Co.
A. SMALLEY
J.F. Portis
Sun Co.
FREDERICK MARTIN